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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/659,375	09/08/2000	Tomowaki Takahashi	1539.1002 RE/JGM/DMP	5004

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EXAMINER

FINEMAN, LEE A

ART UNIT PAPER NUMBER

2872

DATE MAILED: 04/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/659,375

Applicant(s)

TAKAHASHI, TOMOWAKI

Examiner

Lee Fineman

Art Unit

2872

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-58 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-26 and 58 is/are allowed.
- 6) ☒ Claim(s) 27-30, 32-35, 37-50, 52, 54, 56 and 57 is/are rejected.
- 7) ☒ Claim(s) 31, 36, 51, 53 and 55 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 September 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☒ Certified copies of the priority documents have been received in Application No. see below.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 13.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: .

13) a) 2. Application Nos. 08/858560; 08/515631; 08/429970; 08/552453; 08/628165; 08/212639

DETAILED ACTION

1. The previous final rejection, dated 12 March 2002 is withdrawn due to the reasons stated in the office communication dated 16 July 2002. Claims 1-58 are pending.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 27-30, 32-35, 37, 39-42, 44-47, 49-50, 52, 54, and 56-57 are rejected under 35 U.S.C. 102(b) as being anticipated by Schoenmakers, U.S. Patent No. 5,323,263.

Regarding claims 27, 37 and 40, Schoenmakers discloses a catadioptric imaging optical system (fig. 1) in a projection exposure apparatus that transfers a pattern on a reticle onto a substrate (column 2, lines 64-66), said system comprising a catadioptric imaging optical sub-system comprising an optical group (20, 30, 40, 50) to form an image of the pattern, the optical group comprising a concave mirror (40) with a first optical axis (through 40); a dioptric imaging sub-system (60, 80) arranged in an optical path between said catadioptric imaging optical sub-system and the substrate (15) to re-image the image formed by said catadioptric imaging optical sub-system, said dioptric imaging sub-system comprising a second optical axis (through 80) wherein the first optical axis and the second optical axis are not parallel to each other, and the reticle (12) and the substrate are arranged to be parallel to each other, and said catadioptric

Art Unit: 2872

imaging optical system forms an exposure region (15) on the substrate that is off of the second axis (through 80). The method of utilizing the structure of the claim is inherent therein.

Regarding claims 28 and 29, Schoenmakers further discloses wherein the optical group of said catadioptric imaging optical sub-system comprises a first optical subgroup (20) comprising a third optical axis (through 20), and a second optical subgroup comprising the concave mirror (30, 40, 50) and the first optical axis (through 40) and wherein the third optical axis and the second optical axis are parallel to each other.

Regarding claim 30, Schoenmakers further discloses wherein the second optical subgroup comprises a negative lens (50d) and a positive lens (50e).

Regarding claim 32, Schoenmakers further discloses wherein the image formed by said catadioptric imaging optical sub-system is a primary image of the pattern on the reticle (90).

Regarding claim 33, Schoenmakers further discloses a first turning mirror (87) arranged in an optical path between the concave mirror (40) and said dioptric imaging optical sub-system (60, 80).

Regarding claims 34 and 35, Schoenmakers further discloses a second turning, mirror (85) arranged in an optical path between the concave mirror (40) and the reticle (12).

Regarding claims 34 and 35, Schoenmakers further discloses wherein a σ can be varied, σ being a ratio of a numerical aperture of said catadioptric imaging optical system to a numerical aperture of said illumination optical system (column 3, lines 61-68).

Regarding claims 41, 44-45, 52 and 54, Schoenmakers further discloses a catadioptric imaging optical sub-system (20, 30, 40, 50) in an optical path between the reticle (12) and the substrate (15), said catadioptric imaging optical sub-system comprising a first optical group with

Art Unit: 2872

a lens (20) with a first optical axis (through 20), and a second optical group with a concave mirror (40) with a second optical axis (through 40); and a dioptric imaging sub-system (60, 80) with a third optical axis (through 80) arranged in an optical path between said catadioptric imaging optical sub-system and said substrate, wherein the first optical axis and second optical axis intersect, wherein the second optical axis and the third optical axis intersect, wherein the first and third optical axes are parallel to each other, and wherein a primary image (90) of the reticle is formed. The method of utilizing the structure of the claim is inherent therein.

Regarding claim 42, Schoenmakers further discloses wherein said catadioptric imaging optical system forms the pattern on the reticle (12) that is off of the first optical axis onto an exposure region on the substrate (15) that is off of the third optical axis.

Regarding claims 46, 47 and 49-50, Schoenmakers further discloses a first turning mirror (85) arranged in an optical path between the reticle (12) and the substrate (15), a concave mirror arranged (40) in an optical path between said first turning mirror and the substrate, a second turning mirror (87) arranged in an optical path between said concave mirror and the substrate, and a dioptric imaging optical sub-system (60, 80) arranged between said second turning mirror and the substrate and comprising an optical axis, wherein the reticle and the substrate are arranged to be parallel to each other, wherein an intermediate, primary image (90) of the pattern is formed in an optical path between the concave mirror (40) and the dioptric imaging optical sub-system (60, 80), and wherein said catadioptric imaging optical system forms the pattern on the reticle (12) that is off of the optical axis onto an exposure region on the substrate (15) off of the optical axis. The method of utilizing the structure of the claim is inherent therein.

Art Unit: 2872

Regarding claims 56 and 57, Schoenmakers further discloses wherein the dioptric imaging, optical sub-system comprises an optical axis along a straight line (through 80).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 38, 43 and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schoenmakers in view of admitted prior art, column 10, lines 37-41.

Schoenmakers discloses the claimed invention as set forth above but is silent as to the reticle and the substrate being scanned at different speeds corresponding to the magnification of said catadioptric imaging optical system. Admitted prior art, column 10, lines 37-41, teaches systems where the reticle and the substrate being scanned at different speeds corresponding to the magnification of the catadioptric imaging optical system. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have to the reticle and the substrate being scanned at different speeds corresponding to the magnification of said catadioptric imaging optical system as suggested in the admitted prior art to provide high resolution imaging.

Allowable Subject Matter

6. Claims 1-26 and 58 are allowed.

Art Unit: 2872

7. Claims 31, 36, 51, 53, and 55 objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

8. The following is an examiner's statement of reasons for allowance:

Claims 1-26 and 58 are allowable over the prior art for at least the reason that the prior art fails to teach and/or suggest a catadioptric projection system or method with "the first imaging system comprising in order from the reticle (a) a single-pass lens group comprising a first negative subgroup, a positive subgroup, and a second negative subgroup and (b) a double-pass lens group comprising a concave mirror" and "a second imaging system that receives light reflected by the first turning mirror and that re-images the intermediate image to form a final image of the illuminated region of the reticle on the substrate" as set forth in the claimed combination.

Claim 31 is allowable over the prior art for at least the reason that the prior art fails to teach and/or suggest a catadioptric projection system "wherein said dioptric imaging optical subsystem further comprises an aperture stop" as set forth in the claimed combination.

Claim 36 is allowable over the prior art for at least the reason that the prior art fails to teach and/or suggest a catadioptric projection system "wherein the third optical axis and the second optical axis intersect" as set forth in the claimed combination.

Art Unit: 2872

Claims 51, 53, and 55 are allowable over the prior art for at least the reason that the prior art fails to teach and/or suggest a catadioptric projection system or method "wherein the second and third optical axes form a straight optical axis" as set forth in the claimed combination.

Schoenmakers discloses a catadioptric imaging optical system (fig. 1) in a projection exposure apparatus that transfers a pattern on a reticle onto a substrate (column 2, lines 64-66), said system comprising a catadioptric imaging optical sub-system comprising an optical group (20, 30, 40, 50) to form an image of the pattern, the optical group comprising a concave mirror (40) with a first optical axis (through 40) wherein the optical group of said catadioptric imaging optical sub-system comprises a first optical subgroup (20) comprising a third optical axis (through 20); a dioptric imaging sub-system (60, 80) arranged in an optical path between said catadioptric imaging optical sub-system and the substrate (15) to re-image the image formed by said catadioptric imaging optical sub-system, said dioptric imaging sub-system comprising a second optical axis (through 80) but does not the first imaging system comprising in order from the reticle (a) a single-pass lens group comprising a first negative subgroup, a positive subgroup, and a second negative subgroup and (b) a double-pass lens group comprising a concave mirror, wherein said dioptric imaging optical subsystem further comprises an aperture stop, and wherein the third optical axis and the second optical axis intersect as claimed.

Further, Schoenmakers discloses a catadioptric imaging optical sub-system (20, 30, 40, 50) in an optical path between the reticle (12) and the substrate (15), said catadioptric imaging optical sub-system comprising a first optical group with a lens (20) with a first optical axis (through 20), and a second optical group with a concave mirror (40) with a second optical axis (through 40); and a dioptric imaging sub-system (60, 80) with a third optical axis (through 80)

Art Unit: 2872


arranged in an optical path between said catadioptric imaging optical sub-system and said substrate, wherein the first optical axis and second optical axis intersect, wherein the second optical axis and the third optical axis intersect, wherein the first and third optical axes are parallel to each other, but does not have wherein the second and third optical axes form a straight optical axis as claimed.


Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lee Fineman whose telephone number is (703) 305-5414. The examiner can normally be reached on Monday - Friday 7:30 - 4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cassandra Spyrou can be reached on (703) 308-1687. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9318 for regular communications and (703) 872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-4900.


LAF
March 31, 2003


Cassandra Spyrou
Supervisory Patent Examiner
Technology Center 2800